Bond has found. Since the methods employed are entirely dissimilar, and since Bond's investigation has chiefly to do with the Moon and *Jupiter*, both of which he has observed at altitudes generally much greater than those at which the observation of *Venus* is possible, this discordance does not prove much.

Orwell Park Observatory, near Ipswich,
1876, *June* 1.

On the Proper Motion of Bright Spots on Jupiter.

By John Brett, Esq.

There have recently appeared upon the disk of *Jupiter* two bright spots, of such distinctness and isolation as peculiarly adapt them for measurement, with a view to determine either the rotation of the planet, or their own proper motion.

I beg leave to lay before the Society the record of four observations of these spots, forming a series extending over a period of 286 hours 20 minutes of mean time, and to ask whether they afford evidence of proper motion, or whether, on the other hand, they tend to cast any doubt on the accepted rotation of the planet. There were several peculiarities about these two spots which seem to me to give them an eminent claim to attention. They occurred very near to the equator, and were very well defined, and free from entanglement with other markings: an advantage which they have maintained with singular uniformity throughout the period mentioned; but the special peculiarity to which attention is asked is, that during an interval of five days they remained in the same relative position, without any variation whatever.

Their stability in respect of latitude during those five days is undoubted; but the question is, whether or not they were equally stable in longitude. This remark only applies to the first five days of the series, because at the end of twelve days a certain deviation was obvious, as may be seen from the drawings which accompany this paper.

The drawings are fairly accurate, and I have no excuse to offer for them if they are not so. It is more easy for a practised draughtsman to detect differences of position or extension by the unassisted eye than by the micrometer-wire; and this is especially true of such delicate phenomena as planetary markings.

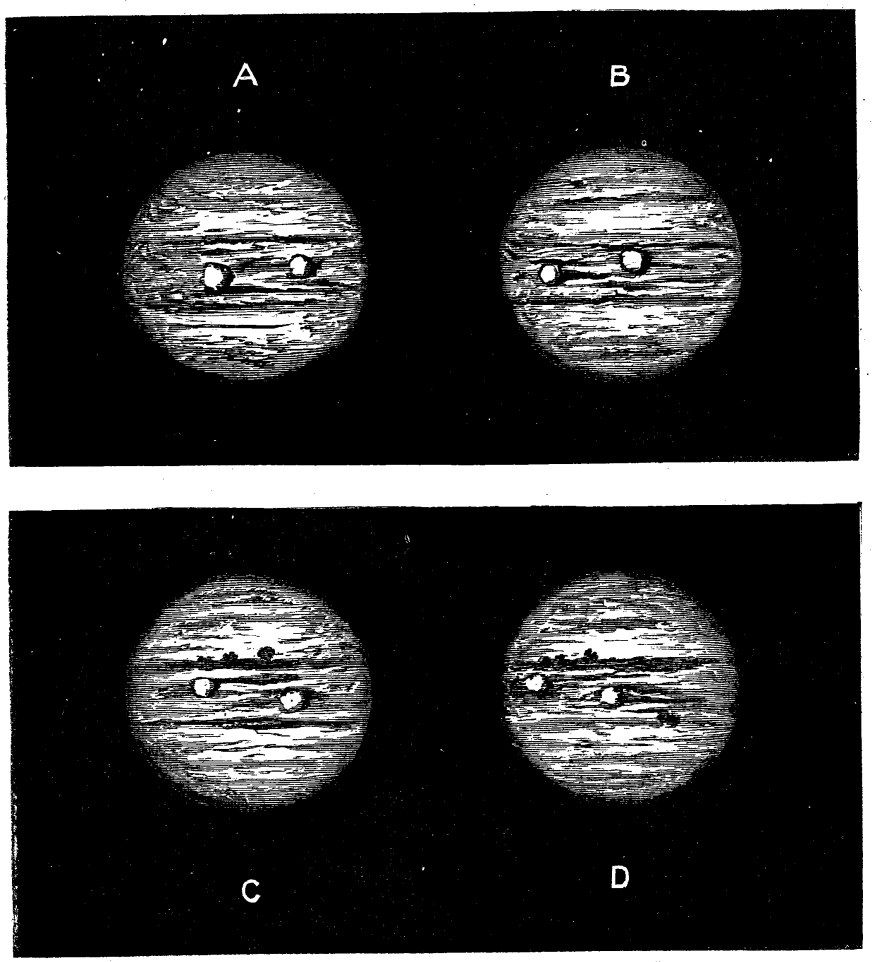
The first observation was made on May 23rd, 1876, at $11^h\ 30^m$ G.M.T., and is recorded by the drawing marked A.

The second observation, May 28, 1876, at $10^h\ 30^m$ G.M.T., by the drawing B.

The distance between the two spots occupies about 42° of Jovian longitude, or about 33,000 miles. Their diameter is nearly

equal, being estimated at $\frac{1}{14}$ of the planet's diameter, or 6,310 miles. The interval of time between these two observations is 119 hours, that is to say, 12 rotations of the planet, according to Airy's determination, during which time their distance apart and their latitude remained constant. The remark to be made upon this pair of observations is that there is a discrepancy between them amounting to $44^m\ 6^s$ of time.

Assuming Airy's rotation, viz., $9^h\ 55^m\ 21^s$, the spots have gained on the planet's surface at the rate of $4^m\ 2^s$ in each revolution.



Between the latter of these two observations and the next of the series there is an interval of seven days, = 17 rotations of the planet; and the same two spots turn up again somewhat earlier than the calculated time.

It unfortunately happens that on this occasion their configuration has undergone some change; but their dimensions and the distance between them remain very much as before. The most important circumstance respecting them is, that their rate of progress shows a certain acceleration.

They appear to have gained on the assumed rotation during this interval at the rate of $7^m\ 14^s$ per revolution.

Between the drawings C and D, the last of the series, there is an interval of 20 minutes of time, during which the spots passed over about 15° of longitude, proving that they were certainly not losing on the rotation.

Taking the series of observations together, the conclusion I derive from them is that the period of the spots is less than the rotation of the planet, and that their least proper motion is 165 miles per hour.

It will not be denied that this, if established, is a very remarkable circumstance.

The only alternative inference, viz., that there is an error in the assumed rotation, is negatived by the consideration that the rate of the spots is not uniform. It must, however, be remembered that the rotation is derived from observations of some such spots.

The proper motion theory is not without its difficulties. It must not be forgotten that these phenomena which are described as bright spots are bodies of approximately globular form. The fact of their casting shadows was discussed before this Society two years ago, and the existence of those shadows has since been confirmed in a paper presented to the French Academy last November by M. Faye.

The shadows of the two spots under consideration are sufficiently pronounced to indicate a globular form, and to afford evidence that light can penetrate the planet to the depth of more than 6,000 miles; but that the material of which it consists is sufficiently limpid at that depth to allow bodies nearly as large as the *Earth* to swim about in it seems at first sight rather startling, not to mention the question what inducement or excuse they could have for advancing in the direction of the planet's rotation.

The fact that they are wholly immersed in the semi-transparent material of the planet is indisputable, since they gradually disappear as they approach the limb, and in no case have been seen to protrude beyond it.

I cannot imagine any subject in physical astronomy on which diligent observation is more required, or one on which good observing faculties may be more fruitfully employed. I may mention that a 9-inch reflector shows these phenomena in a very satisfactory manner, but they *can* be seen with a 4-inch refractor. As the planet approaches quadrature the shadows ought to become more obvious, so that we may hope to hear more of them before the next session of the Society.

June 9, 1876.